

ABSTRACT OF THE DISCLOSURE

A liquid crystal optical modulator is operated as a concave lens using a quadratic curve modulation area of a refractive index modulation area of a liquid crystal molecule layer, which is different from a conventional convex lens operation area, without changing the configuration of the liquid crystal optical modulator. In addition, the liquid crystal optical modulator is operated as a concave lens using a quadratic curve modulation area used by a conventional liquid crystal optical modulator as well as an area different from that area to enable the liquid crystal optical modulator to operate as a convex lens and as a concave lens. This makes it possible to perform the concave lens operation, to enlarge the variable focal range, and to form a micro-lens array of variable focal point type.